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Laser Torch Based Voice Transmitter and Receiver

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Abstract

Using this circuit we can communicate with your neighbors wirelessly. Instead of RF signals, light from a laser torch is used as the carrier in the circuit. The laser torch can transmit light up to a distance of about 500 meters. The phototransistor of the receiver must be accurately oriented towards the laser beam from the torch. If there is any obstruction in the path of the laser beam, no sound will be heard from the receiver. The transmitter circuit comprises condenser microphone transistor amplifier BC548 followed by an pomp stage built around µA741. The gain of the op-amp can be controlled with the help of 1-mega-ohm photometer VR 1.The AF output from IC 1is coupled to the base of transistor BD 139 (T2), which, in turn, modulates the laser beam. The transmitter uses 9V power supply. However, the 3-volt laser torch (after removal of its battery) can be directly connected to the circuit with the body of The torch connected to the emitter of BD139 and the spring-loaded lead protruding from inside the torch to circuit ground. The receiver circuit uses an npn phototransistor as the light sensor that is followed by a two-stage transistor pre amplifier and LM386-based audio Power amplifier. The receiver does not need any complicated alignment. Just keep the phototransistor oriented towards the remote transmitter's laser point and adjust the volume control for a clear sound. To avoid 50 Hz hum noise in the speaker, keep the phototransistor away from AC light sources such as bulbs. The reflected sunlight, however, does not cause any problem. But the sensor should not directly face the sun.

Keyword - Laser, LST, RF, LM386, Wireless.

INTRODUCTION

Laser as a communication medium can provide a good substitute for the present day communication systems as the problem of interference faced in case of electromagnetic waves is not there and high deal of secrecy is available. It will easily give a communication distance of several hundred meters, and with a parabolic light reflector, up to several kilometers [1]. The laser-induced lubricant pockets generated high local pressures and thus caused a thicker lubricant film, allowing an optimal separation of the contact surfaces even at lower sliding velocities [2]. It transmits high quality audio and the link is virtually impossible for anyone else to tap into. An important feature of transmission by laser beam is privacy. Because a laser beam is intentionally narrow, it's virtually impossible for someone to tap into the link without us knowing. If someone intercepts the beam, the link is broken, signaling the interception. Fibre-optic cables also have high security, as it's very difficult to splice into the cable without breaking the link. However it's theoretically possible; so for the highest security, we probably cannot beat a line-of-sight laser beam. Also it cannot be detected with use of spectrum analyzers and RF meters and hence can be used for diverse applications including financial, medical and military. Laser Surface Texturing (LST) is probably the most advanced so far. LST produces a very large number of micro-dimples on

the surface and each of these micro-dimples can serve either as a micro-hydrodynamic bearing in cases of full or mixed lubrication, a micro-reservoir for lubricant in cases of starved lubrication conditions, or a micro-trap for wear debris in either lubricated or dry sliding [3]. Lasers can also transmit through glass; however the physical properties of the glass have to be considered. By rotating the media under the focused pulsed-laser beam, a row of crater shaped dimples are created in the landing zone only [4]. Laser transmitter and receiver units ensure easy, straightforward systems alignment and long-term stable, service free operation, especially in inaccessible environments, optical wireless systems offer ideal, economical alternative to expensive leased lines for buildings [5,7]. Over the past 10 Years, laser intensities have increased by more than four orders of magnitude to reach enormous intensities of 1020 W /cm2 [6].The laser can also be commissioned in satellites for communication, as laser radar requires small aperture as compared to microwave radar. As we cannot see the laser beam without special IR sensitive equipment, it also makes alignment more difficult. Further, potential bandwidth of radar using lasers can translate to very precision range measurement. For these reasons, they can be used as an alternative to present modes of communication. Laser communication is both wide-band and high-speed.

DESIGN OF WORKING PRINCIPLE

The block diagram of working principle of the system is shown in Figure .1

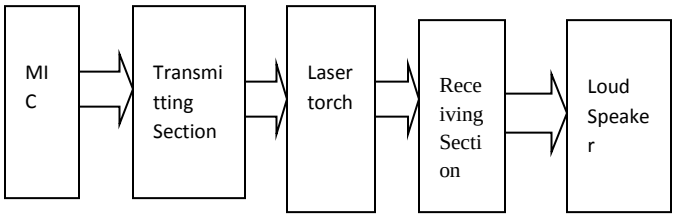

Figure 1 Block Diagram of Working Principle of System.

A) Condenser Microphone

Condenser microphones require power from a battery or external source. Condenser also tends to be more sensitive and responsive than dynamic, making them well suited to capturing subtle nuances in a sound. The diaphragm vibrates when struck by sound waves, changing the distance between the two plates and therefore changing the capacitance. Specifically when the plates are closer together capacitance increases and a charge current occurs and this current will be used to trigger the transmitting section.

B) Transmitting Section

The transmitter section comprises condenser microphone, transistor amplifier BC548 followed by an op-amp stage built around IC1. The gain of the op-amp can be controlled with the help of 1-mega ohm pot meter VR1. The AF output from IC1 is coupled to the base of transistor Bd139, which in turn, modulates the laser beam. The transmitter uses 9V power supply. However, the 3-volt laser torch (after the removal of its battery) can be directly connected to the circuit with the body of the torch connected to the emitter of BD139 and the spring loaded lead protruding from inside the torch to circuit ground. The block diagram of transmitting section is given in Figure 2.

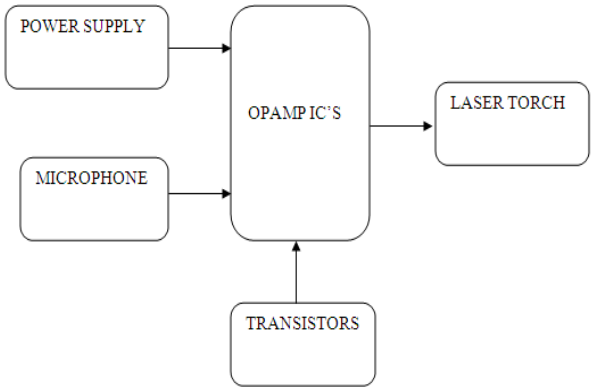

Figure 2 Block Diagram of Transmitting Section.

C) Laser Torch

Here we use the light rays coming from laser torch as the medium for transmission. Laser had potential for the transfer of data at extremely high rates, specific advancements were needed in component performance and systems engineering, Particularly for space-qualified hardware. Free space laser communications systems are wireless connections through the atmosphere. They have worked similar to fibre optic cable systems except the beam is transmitted through open space. The laser systems operate in the near infrared region of the spectrum. The laser light across the link is at a wavelength of between 780 - 920 nm. Two parallel beams are used, one for transmission and one for reception.

D) Receiving Section

The receiver circuit uses an NPN phototransistor as the light sensor that is followed by a two stage transistor preamplifier and LM386-based audio power amplifier. The receiver doesn't need any complicated alignment. Just keep the phototransistor oriented towards the remote transmitter's laser point and adjust the volume control for a clear sound. The block diagram of receiving section is shown in Figure in 3.

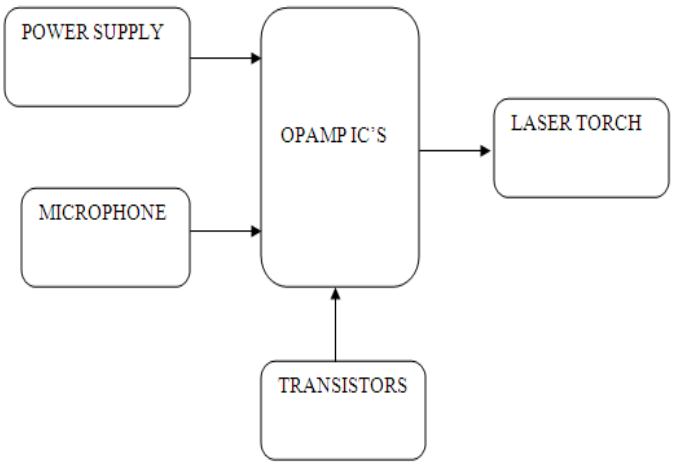

Figure 3 Block Diagram of Receiving Section

E) Loud Speaker

A loudspeaker (or "speaker") is an electro acoustic transducer that converts an electrical signal into sound. The speaker moves in accordance with the variations of an electrical signal and causes sound waves to propagate through a medium such as air or water.

CIRCUIT DESIGN OF SYSTEM

There the transmission distance is no more than meters of so, a LED (or two for increased power) can be substituted for the laser diode.

For instance, there the link is being used for educational purposes, such as demonstrating fibre-optic coupling, or the concept of communication over a light beam. Obviously the security of the transmission is much lower as LEDs transmit light in all directions. While, that laser link can be adapted for use as a perimeter protector. Now to a description of how it all works. As we shall see, it's really very simple. We shall start with the transmitter.

A) Transmitter

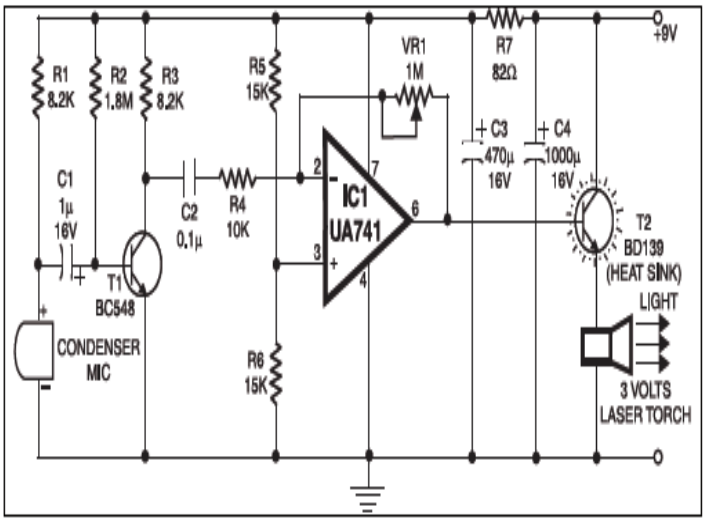

Figure 4 Transmitter Circuit

The mic is the audio input. C1is a coupling capacitor that connects the audio from the mic to T1. T1 is a transistor that is used to amplify the audio a bit. C2 couples the audio to IC1which amplifies it some more. The audio from the IC

is then routed to T2 which modulates the power to the LED.

This puts the audio onto the light beam. VR1 is a variable resistor which adjusts the gain of the IC. C3, C4 andR7 are power filters that remove noise from the power supply. The other resistors just supply the right voltage to the various parts To avoid 50Hz hum noise in the speaker, keep the phototransistor away from AC light sources such as bulbs. The reflected sunlight, however, does not cause any problem. But the sensor should not directly face the sun.

B) Receiver

The transmitted signal is picked up by the photo detector diode in the receiver as shown in Figure 5. The output voltage of this diode is amplified by the common emitter amplifier around Ql. This amplifier has a gain of 20 or so, and connects via VRI to ICI, an LM386 basic power amplifier IC with a gain internally set to 20.

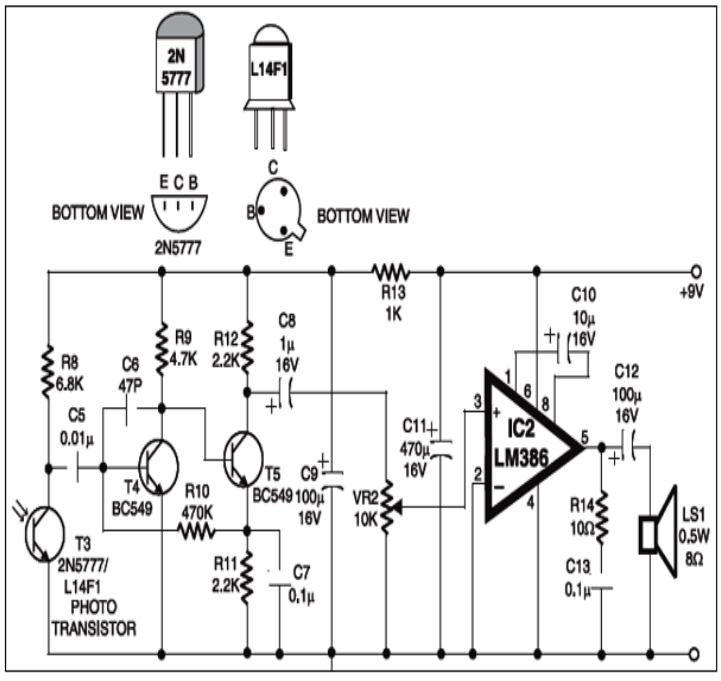

Figure 5 Receiving Circuit

This IC can drive a speaker with a resistance as low as four ohms, and 35OmW when the circuit is powered from a 9V supply. Increasing the sup- ply voltage will increase the output power marginally. The voltage to the transistor amplifier stage is regulated by ZD I to 5.6V, and decoupled from the main supply by R2 and C2. Resistor R3 supplies forward current for the photodiode. (Incidentally, the photodiode used for this experiment has a special clear package, so it responds to visible light, and not just infrared.)

CONCLUSIONS

Using this circuit we can communicate with our neighbors wirelessly. It can be also used in inaccessible areas and conference halls. In future, it can be commissioned in satellite for communication and instead of the short range laser, high range lasers can be used which range a few hundred meters Provisions have to be made for cases when there is no heavy traffic

FUTURE SCOPES

Improved design of this system can be used to transmit confidential voice data from one hill top to other hill top in remote area where cell phone communication is not possible due to the lack of mobile operator's tower by using extra amplifying circuit at the receiver end for having higher efficiency of the system.

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